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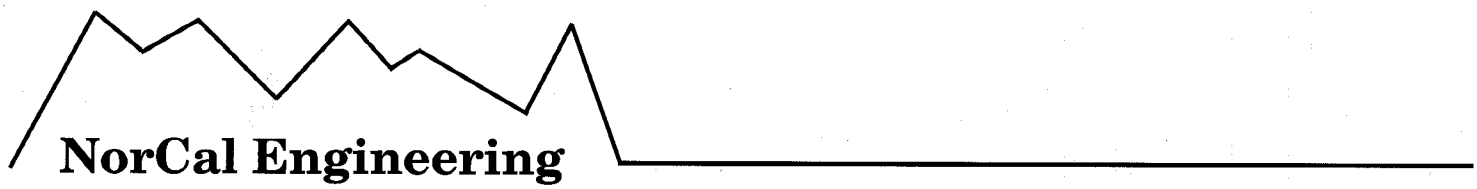
DADS & Co

Geotechnical Investigation
Proposed Harbor Gateway Distribution Warehouse
Los Angeles, California



NorCal Engineering
Soils and Geotechnical Consultants

Geotechnical Investigation
Proposed Harbor Gateway Distribution Warehouse
Los Angeles, California

Prepared For:

McDonnell Douglas Realty Company
4060 Lakewood Boulevard
Building No. 801, Sixth Floor
Lakewood, California 90808

Project Number 6447-96
January 14, 1997

NorCal Engineering

NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS
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(310)799-9469 FAX (310)799-9459

January 14, 1997 Project Number 6447-96

McDonnell Douglas Realty Company
4060 Lakewood Boulevard
Building No. 801, Sixth Floor
Lakewood, California 90808

Attn: Mr. Mario Stavale

RE: **Geotechnical Investigation** - Proposed Harbor Gateway Distribution Warehouse Development - Located on the East Side of Western Avenue, Northerly of West 203rd Street, in the City of Los Angeles, California

Dear Mr. Stavale:

Pursuant to your request, this firm has performed a Geotechnical Investigation for the above referenced project in accordance with your authorization. The purpose of this investigation is to evaluate the geotechnical conditions of the subject site and to provide recommendations for the proposed development. This geotechnical engineering report presents the finding of our study along with conclusions and recommendations for development.

We appreciate this opportunity to be of service to you. If you have any further questions, please do not hesitate to contact the undersigned.

Respectfully submitted,
NORCAL ENGINEERING

Keith D. Tucker
Project Engineer
R.G.E. 841

REGISTERED PROFESSIONAL ENGINEER
KEITH D. TUCKER
No. 841
Exp. 12/31/00
GEOTECHNICAL
STATE OF CALIFORNIA

Troy D. Norrell
President

Structural Considerations

This geotechnical engineering report presents the findings of our study along with engineering analysis and recommendations for the proposed development. It is proposed a warehouse/distribution building consisting of ±346,000 square feet as shown on the included site plan. Other improvements may consist of asphaltic and/or concrete parking, driveway and loading areas. Final building plans shall be reviewed by this firm prior to submittal for city approval to determine the need for any additional study and revised recommendations pertinent to the proposed development, if necessary. In addition, the investigation included land to the east of the proposed building area. No development plans exist for this area at this time.

Site Description

The site is a former loading and unloading area for the McDonnell facility at the southeast corner of Western Avenue and 190th Street. Several railway spurs extend through the property. A few small buildings are located along the northerly property line of the subject site. The remainder of the property is covered mainly by asphaltic concrete pavement, gravel base and low weed and grass cover. A large volume of equipment is currently being stored across the entire site. Location of the materials greatly limited the placement of our test explorations.

Seismicity and Liquefaction Evaluation

There are no known active or potentially active faults trending toward or through the site. The proposed development lies outside of any Alquist Priolo Special Studies Zone and the potential for damage due to direct fault rupture is considered remote. The site is located in an area of high regional seismicity and a maximum credible bedrock acceleration of 0.52g may occur from a Magnitude 6.6 event along the Palos Verdes Hills Fault Zone, which is located about 3 miles southwest of the site.

Ground shaking originating from earthquakes along other active faults in the region is expected to induce lower horizontal accelerations due to smaller anticipated earthquakes and/or greater distances to other faults. The following table provides information on nearby major active faults along with peak horizontal ground accelerations.

Estimated Maximum Probable Ground Motion Parameters

Fault Zone	Approximate Distance From Site (Miles)	Maximum Probable Magnitude (Richter)*	Peak Horizontal Acceleration (g)
Palos Verdes Hills	3SW	6.6	0.52
Newport/Inglewood	5NE	6.6	0.42
Whittier	18NE	6.7	0.25
San Andreas	48NE	8.1	0.15

*From Table 25
Professional Paper 1360, USGS 1985

The subject site is expected to experience ground shaking and earthquake activity that is typical of Southern California area. It is during severe ground shaking that loose, granular soils below the groundwater table can liquefy. Previous boring performed on site and laboratory analyses for our *Preliminary Geotechnical Investigation* report dated March 18, 1996, Project Number 5936-96 reveal that the area has a very low potential for liquefaction. In addition, groundwater in the area is approximated 80 to 90 feet below ground level based upon review of the Fall 1993 groundwater contour map by the County of Los Angeles Department of Public Works. The document *U.S.G.S. Professional Paper 1360, Evaluating Earthquake Hazards in the Los Angeles Region*, Figure 143, also details the area as having a very low liquefaction potential.

Thus, the design of the proposed construction in conformance with the latest Building Code provisions for earthquake design is expected to provide mitigation of ground shaking hazards that are typical to Southern California.

Field Investigation

The purpose of the investigation was to explore the subsurface conditions and to provide preliminary geotechnical engineering design parameters for evaluation of the site with respect to the proposed development.

The investigation consisted of the placement of eighteen subsurface exploratory excavations by a truck mounted hollow-stem auger and backhoe to a maximum depth of 20 feet placed at accessible locations on the site. The explorations were visually classified and logged by a field engineer with locations of the subsurface explorations shown on the attached Site Plan.

The exploratory borings revealed the existing earth materials to consist of pavement section, fill and natural soil zones. A detailed description of the subsurface conditions are listed on the excavation logs in Appendix A. These soils are described as follows:

Fill: Minor amounts of fill soils were encountered across the site and ranged in depth to a slightly more than 12 inches. The fill consisted of silty CLAYS with minor debris, ballast materials from the existing railway spurs and base material. These materials were generally loose to moderately dense and damp to moist. The majority of the fill materials may be reutilized as compacted fill during site grading operations.

Natural: Native, undisturbed soils classifying as silty and sandy CLAY were encountered beneath the upper pavement section. These materials were also observed to be stiff and were moist to very moist. Recent rains in the area are undoubtedly responsible for some of the elevated moisture conditions. Clay content tended to decrease slightly with depth of excavation and sand content increased in most cases. The pavement section encountered in the central portion of the site measured 3 inches of asphalt overlying 2 inches of base material. A pea gravel and asphalt mixture was encountered in test excavations 10-13. This layer at the surface measured about one-half inch in thickness.

Laboratory Tests

Relatively undisturbed samples of the subsurface soils were obtained to perform laboratory testing and analysis for direct shear, consolidation tests and to determine in-place moisture/densities. These undisturbed samples consisted of one inch rings with inside diameter of 2.5 inches. Bulk bag samples were obtained in the upper soils for expansion index tests and maximum density tests.

Wall loadings on the order of 4,000 lbs./lin.ft. and maximum compression loads on the order of 100 kips were utilized for testing and design purposes. All test results are included in Appendix B, unless otherwise noted.

A. The field moisture content (ASTM:D 2216) and the dry density of the ring samples were determined in the laboratory. This data is listed on the logs of borings.

B. Maximum density tests (ASTM: D-1557-78) were performed on typical samples of the upper soils. Results of these tests are shown on Table I.

C. Expansion index tests in accordance with the Uniform Building Code Standard No. 29-2 were performed on remolded samples of the upper soils to determine the expansive characteristics and to provide any necessary recommendations for reinforcement of the slabs-on-grade and the foundations. Results of these tests are provided on Table II.

D. Direct shear tests (ASTM: D-3080) were performed on undisturbed and disturbed samples of the subsurface soils. These tests were performed to determine parameters for the calculation of the safe bearing capacity. The test is performed under saturated conditions at loads of 500 lbs./sq.ft., 1,000 lbs./sq.ft., and 2,000 lbs./sq.ft. with results shown on Plate A.

E. Consolidation tests (ASTM: D-2435) were performed on undisturbed samples to determine the differential and total settlement which may be anticipated based upon the proposed loads. Water was added to the samples at a surcharge of one KSF and the settlement curves are plotted on Plate B.

F. The potential corrosive effects of the on-site soils to concrete are being determined in the laboratory. Test results and any further recommendations regarding concrete design will be provided in an addendum to this report.

Conclusions and Recommendations

Based upon our evaluations, the proposed development is acceptable from a geotechnical engineering standpoint. By following the recommendations and guidelines set forth in our report, the structures will be safe from excessive settlements under the anticipated design loadings and conditions. The proposed development shall meet all requirements of the City Building Ordinance and will not impose any adverse effect on existing adjacent structures.

It is recommended that site inspections be performed by a representative of this firm during all grading and construction of the development to verify the findings and recommendations documented in this report. Any unusual conditions which may be encountered in the course of the project development may require the need for additional study and revised recommendations.

Site Grading Recommendations

Any vegetation shall be removed and hauled from proposed grading areas prior to the start of grading operations. Any removed soils may be reutilized as compacted fill once any deleterious material or oversized materials (in excess of eight inches) is removed. All grading operations shall be performed in accordance with the attached "Specifications for Compacted Fill Operations". The upper ±12 inches of the encountered fill soils shall be removed to medium stiff native material, the exposed surface scarified to a depth of 12 inches, brought to the proper moisture content and compacted to a minimum of 90% of the laboratory standard (ASTM: D-1557-78) prior to placement of any additional compacted fill soils, foundations, slabs-on-grade and pavement.

Grading for structures shall extend a minimum of 5 horizontal feet outside the edges of foundations or to a horizontal distance equal to the depth of fill placed, whichever is greater, where possible. Aeration and stabilization of the on-site soils may be necessary in some areas due to the existing high moisture contents.

It is possible that isolated areas of undiscovered fill not described in this report are present on site. If found, these areas should be treated as discussed earlier. A diligent search shall also be conducted during grading operations in an effort to uncover any underground structures, irrigation or utility lines. If encountered, these structures and lines shall be either removed or properly abandoned prior to the proposed construction. Care should be taken to provide or maintain adequate lateral support for all adjacent improvements and structures at all times during the grading operations and construction phase. Adequate drainage away from the structures, pavement and slopes should be provided at all times.

Shrinkage and Subsidence

Results of our in-place density tests reveal that the soil shrinkage will be on the order of 15 to 18% due to excavation and recompaction, based upon the assumption that the fill is compacted to 92% of the maximum dry density per ASTM standards. Subsidence should be 0.15 feet due to earthwork operations. The volume change does not include any allowance for vegetation or organic stripping, removal of subsurface improvements or topographic approximations.

Although these values are only approximate, they represent our best estimate of lost yardage which will likely occur during grading. If more accurate shrinkage and subsidence factors are needed, it is recommended that field testing using the actual equipment and grading techniques should be conducted.

Temporary Excavations

Temporary excavations in the site soils may be made at vertical inclinations up to 5 feet in height. Temporary unsurcharged excavations in the existing site materials may be trimmed at a 1 to 1(horizontal to vertical) gradient. In areas where soils with little or no binder are encountered, where adverse geological conditions are exposed, or where excavations are adjacent to existing structures, shoring, slot-cutting, or flatter excavations may be required. The temporary cut slope gradients given above do not preclude local raveling and sloughing. All excavations shall be made in accordance with the requirements of CAL-OSHA and other public agencies having jurisdiction.

Slot-cutting per the A-B method will be required during grading operations when excavations are made adjacent to the existing structures. Soils shall be removed adjacent to the buildings in alternating 10 feet long sections (A slots) while leaving 10 feet of soils (B slots) in place against the building to provide support during excavation and recompaction operations. The B slots may be removed only after the A slots have been properly recompacted and lateral support for the existing building is restored.

Foundation Design

All foundation excavations may be designed utilizing the following safe bearing capacities for an embedded depth of 24 inches into stiff compacted fill or competent native soils with the corresponding widths:

Allowable Safe Bearing Capacity (psf)

Width (ft)	Continuous Foundation	Isolated Foundation
1.5	1500	2000
2.0	1575	2075
4.0	1875	2375
6.0	2175	2675

A substantial decrease in the above bearing capacities will be necessary if the required compacted fill blanket is not provided beneath foundations. Care should be taken to not impose any surcharge on the existing building footings by new foundations.

A one-third increase may be used when considering short term loading from wind and seismic forces. All continuous foundations shall be reinforced with a minimum of one #4 bar, top and bottom. Isolated foundations shall be reinforced as recommended by the project structural engineer.

A representative of this firm shall inspect all foundation excavations prior to pouring concrete.

Lateral Resistance

The following values may be utilized in resisting lateral loads imposed on the structure. Requirements of the Uniform Building Code should be adhered to when the coefficient of friction and passive pressures are combined.

Coefficient of Friction - 0.35
Equivalent Passive Fluid Pressure = 200 lbs./cu.ft.
Maximum Passive Pressure = 2,000 lbs./cu.ft.

The passive pressure recommendations are valid only for either competent native soils and/or compacted fill soils.

Settlement Analysis

Resultant pressure curves for the consolidation tests are shown on Plate B. Computations utilizing these curves and the recommended safe bearing capacities reveal that the foundations will experience settlements on the order of 3/4 inch and differential settlements of less than 1/4 inch.

Retaining Wall Design Parameters

Active earth pressures against retaining walls will be equal to the pressures developed by the following fluid densities. These values are for **granular backfill material** placed behind the walls at various ground slopes above the walls.

Surface Slope of Retained Materials (Horizontal to Vertical)	Equivalent Fluid Density (lb./cu.ft.)
Level	30
5 to 1	35
4 to 1	38
3 to 1	40
2 to 1	45

Any applicable short-term construction surcharges and seismic forces should be added to the above lateral pressure values. All walls shall be waterproofed as needed and protected from hydrostatic pressure by a reliable permanent subdrain system.

Slab Recommendations

All concrete slabs-on-grade shall be a minimum of five inches in thickness, reinforced with #4 bars at 24 inches on center, placed mid-height in the slab, and may be placed on approved compacted fill soils. Slab thickness may need to be increased based upon proposed loading conditions. A vapor barrier should be utilized in areas which would be sensitive to the infiltration of moisture. This membrane should be placed between a 4-inch thick select sand layer and not directly beneath the concrete due to the possibility of curling of the slab. Subgrade soils shall be moistened to 130% of optimum moisture levels immediately prior to pouring of concrete. All concrete slab areas to receive floor coverings should be moisture tested to meet all manufacturer requirements prior to placement.

Preliminary Pavement Section Design

The table below provides a preliminary pavement design based upon an estimated R-Value of 20 for the proposed development. Final pavement design should be based on R-Value testing of the subgrade soils near the conclusion of rough grading to assure that these soils are consistent with those assumed in this preliminary design.

Flexible Pavement Section Design

Type of Traffic	Traffic Index	Inches Asphalt	Inches Base
Auto Parking	4	3.0	5.0
Auto Drive/Circulation	5	3.0	8.0
Medium Truck Access (GVW < 42,000 lbs.; 3 axle)	6	3.5	10.0
Heavy Truck Access (GVW < 90,000 lbs.; 5 axle)	7	3.5	14.0

Any concrete slabs utilized for heavy trucks and forklifts shall be a minimum of six inches in thickness and placed on approved fill soils recompacted to a minimum of 95% relative compaction. Any approved base material shall conform to *Standard Specifications for Public Works Construction* (Green Book) section 200-2.4.2, fine designation, and should be compacted to a minimum of 95% relative compaction.

It is recommended that traffic volumes and loadings be submitted to this firm for further evaluation to assure that the above recommendations are suitable for the planned site traffic conditions.

Closure

The recommendations and conclusions contained in this report are based upon the soil conditions uncovered in our test excavations. No warranty of the soil condition between our excavations is implied. NorCal Engineering should be notified for possible further recommendations if unexpected to unfavorable conditions are encountered during construction phase. It is the responsibility of the owner to ensure that all information within this report is submitted to the Architect and appropriate Engineers for the project.

This firm should have the opportunity to review the final plans to verify that all our recommendations are incorporated. This report and all conclusions are subject to the review of the controlling authorities for the project.

A preconstruction conference should be held between the developer, general contractor, grading contractor, city inspector, architect, and soil engineer to clarify any questions relating to the grading operations and subsequent construction. Our representative should be present during the grading operations and construction phase to certify that such recommendations are complied within the field.

The geotechnical investigation has been conducted in a manner consistent with the level of care and skill exercised by members of our profession currently practicing under similar conditions in the Southern California area. No other warranty, expressed or implied is made.

SPECIFICATIONS FOR PLACEMENT OF COMPACTED FILL

Preparation

Any existing low density soils and/or saturated soils shall be removed to competent natural soil under the inspection of the Soils Engineering Firm. After the exposed surface has been cleansed of debris and/or vegetation, it shall be scarified until it is uniform in consistency, brought to the proper moisture content and compacted to a minimum of 90% relative compaction (in accordance with ASTM: D-1557-78).

Material For Fill

The on-site soils or approved import soils may be utilized for the compacted fill provided they are free of any deleterious materials and shall not contain any rocks, brick, asphaltic concrete, concrete or other hard materials greater than eight inches in maximum dimensions. Any import soil must be approved by the Soils Engineering firm a minimum of 24 hours prior to importation of site.

Placement of Compacted Fill Soils

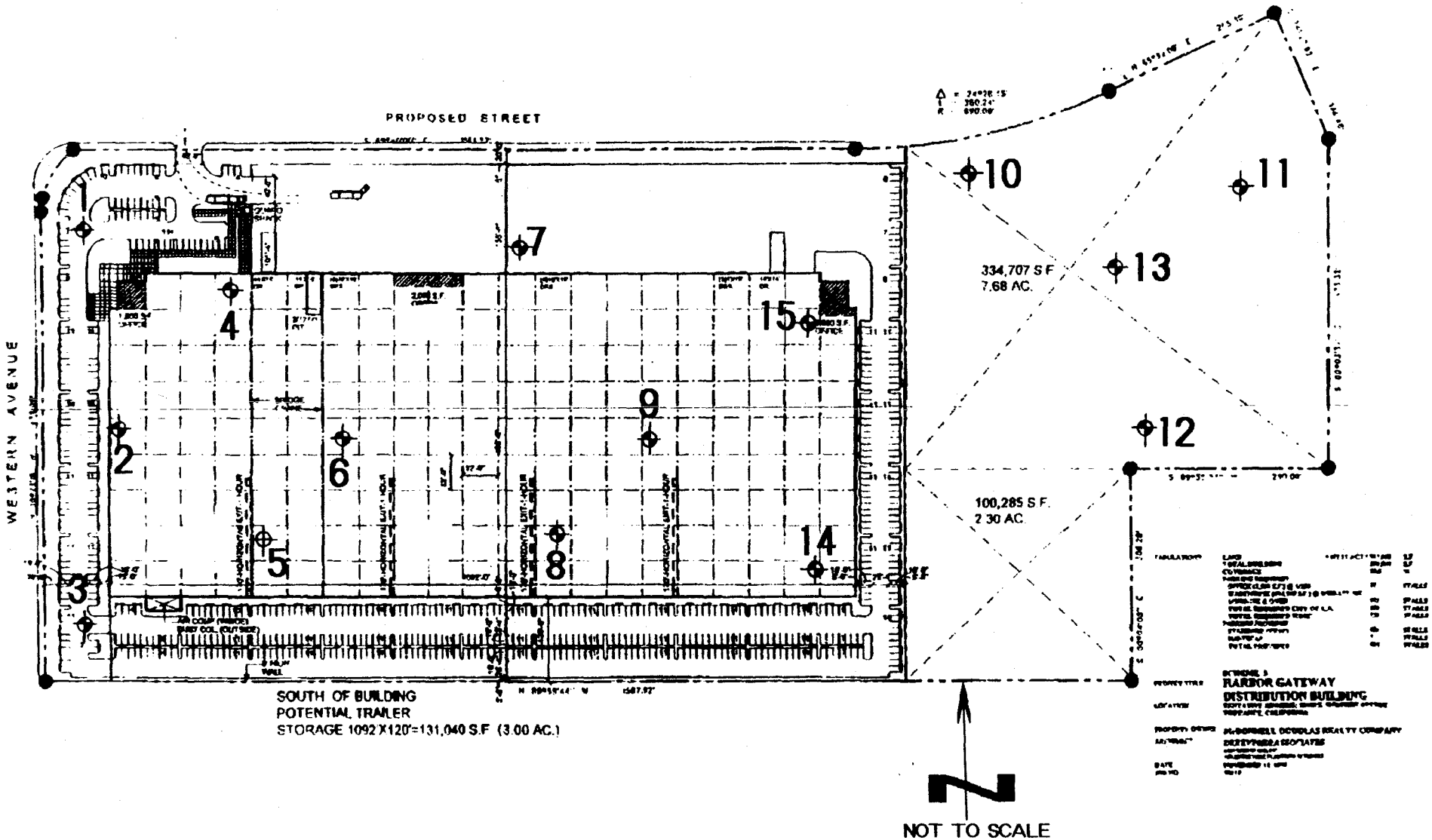
The approved fill soils shall be placed in layers not excess of six inches in thickness. Each lift shall be uniform in thickness and thoroughly blended. The fill soils shall be brought to within 15% of the optimum moisture content, unless otherwise specified by the Soils Engineering firm. Each lift shall be compacted to a minimum of 90% relative compaction (in accordance with ASTM: D-1557-78) and approved prior to the placement of the next layer of soil. Compaction tests shall be obtained at the discretion of the Soils Engineering firm but to a minimum of one test for every 500 cubic yards placed and/or for every 2 feet of compacted fill placed.

The minimum relative compaction shall be obtained in accordance with accepted methods in the construction industry. The final grade of the structural areas shall be in a dense and smooth condition prior to placement of slabs-on-grade or pavement areas. No fill soils shall be placed, spread or compacted during unfavorable weather conditions. When the grading is interrupted by heavy rains, compaction operations shall not be resumed until approved by the Soils Engineering firm.

Grading Observations

The controlling governmental agencies should be notified prior to commencement of any grading operations. This firm recommends that the grading operations be conducted under the observation of a Soils Engineering firm as deemed necessary. A 24 hour notice must be provided to this firm prior to the time of our initial inspection.

Observation shall include the clearing and grubbing operations to assure that all unsuitable materials have been properly removed; approve the exposed subgrade in areas to receive fill and in areas where excavation has resulted in the desired finished grade and designate areas of overexcavation; and perform field compaction tests to determine relative compaction achieved during fill placement. In addition, all foundation excavations shall be observed by the Soils Engineering firm to confirm that appropriate bearing materials are present at the design grades and recommend any modifications to construct footings.



NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS

MCDONNELL-DOUGLAS

PROJECT 6447-96 | DATE JAN. 1997

APPROXIMATE LOCATION OF FIELD EXPLORATIONS

January 14, 1997 Project Number 6447-96

APPENDICES

(In order of appearance)

Appendix A - Logs of Test Explorations
***Logs of Test Explorations 1 to 15**

Appendix B - Laboratory Analysis
***Table I - Maximum Dry Density Tests**
***Table II - Expansion Index Tests**

***Plate A - Direct Shear Tests**
***Plate B - Consolidation Tests**

NorCal Engineering

January 14, 1997 Project Number 6447-96

APPENDIX A

NorCal Engineering

MAJOR DIVISIONS			SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (MORE THAN 50% OF MATERIAL IS LARGER THAN 200 SIEVE SIZE)	GRAVELS (MORE THAN 50% OF COARSE FRACTION IS LARGER THAN THE NO. 4 SIEVE SIZE)	CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES.
			GP	POORLY GRADED GRAVELS OR GRAVEL - SAND MIXTURES, LITTLE OR NO FINES.
		GRAVELS WITH FINES (APPRECIABLE AMT. OF FINES)	GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES.
			GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES.
	SANDS (MORE THAN 50% OF COARSE FRACTION IS SMALLER THAN THE NO. 4 SIEVE SIZE)	CLEAN SANDS	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES.
			SP	POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES.
		SANDS WITH FINES (APPRECIABLE AMT. OF FINES)	SM	SILTY SANDS, SAND - SILT MIXTURES.
			SC	CLAYEY SANDS, SAND - CLAY MIXTURES.
FINE GRAINED SOILS (MORE THAN 50% OF MATERIAL IS SMALLER THAN 200 SIEVE SIZE	SILTS AND CLAYS (LIQUID LIMIT LESS THAN 50)		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY.
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS.
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS
	SILTS AND CLAYS (LIQUID LIMIT MORE THAN 50)		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS.
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS.
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

BOUNDARY CLASSIFICATIONS: SOILS POSSESSING CHARACTERISTICS OF TWO GROUPS ARE DESIGNATED BY COMBINATIONS OF GROUP SYMBOLS

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UNIFIED SOIL CLASSIFICATION SYSTEM

PROJECT | DATE

	MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
	18.2			B	0	SURFICIAL FILL SOILS with ballast	
						NATIVE SOILS CLAY, silty, sandy, reddish brown, stiff, very moist	
					5	SAND, clayey, tan, dense, moist	
					10		
					15		
					20		
					25		
					30		
					35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 12/17/96
EQUIPMENT USED: Backhoe
GROUNDWATER LEVEL: Not encountered

NorCal Engineering
SOILS AND GEOTECHNICAL CONSULTANTS

LOG OF TEST EXPLORATION #1

PROJECT 6447-96 **DATE**

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
				0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					SURFICIAL FILL - Loose, wet	
19.1			B	5	NATIVE SOILS CLAY, silty, sandy, dark brown, stiff, moist to very moist, change to light brown at 3.5 ft., less clay content with depth	
				10		
				15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- C Rock Core
- S Standard Split Spoon
- R Ring Sample
- B Bulk Sample
- J Jar Sample

DATE DRILLED: 12/17/96
EQUIPMENT USED: Backhoe
GROUNDWATER LEVEL: Not encountered

NorCal Engineering
SOILS AND GEOTECHNICAL CONSULTANTS

LOG OF TEST EXPLORATION #2

PROJECT 6447-96 **DATE**

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
				0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					FILL SOILS Silty CLAY with gravel, brown, soft, wet	
				5	NATIVE SOILS CLAY, silty, dark brown, stiff, very moist	
				10		
				15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 12/17/96
EQUIPMENT USED: Backhoe
GROUNDWATER LEVEL: Not encountered

NorCal Engineering
SOILS AND GEOTECHNICAL CONSULTANTS

LOG OF TEST EXPLORATION #3

PROJECT 6447-96 **DATE**

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
16.8	107.7		R	0	SURFICIAL FILL SOILS - Loose, wet with gravel	
15.3	113.8		R		CLAY, silty, dark brown, stiff, very moist to wet, slight decrease in moisture content with depth, broke old 6" sewer line at 2.5 ft.	
19.0	103.3		R	5	CLAY, sandy, tan, stiff, moist	
20.2	104.5		R		SILT, clayey with some sand, tan, stiff, moist	
17.7	105.1		R	10		
16.6	106.7		R	15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 12/17/96
EQUIPMENT USED: Backhoe
GROUNDWATER LEVEL: Not encountered

NorCal Engineering
SOILS AND GEOTECHNICAL CONSULTANTS

LOG OF TEST EXPLORATION #4

PROJECT 6447-96 **DATE**

	MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
						SURFICIAL FILL SOILS - Loose, wet with root structures, occasional gravel	
	14.6	108.1		R	5	CLAY, silty, sandy, dark brown, stiff, moist to very moist, increase in density at 3 ft., very stiff at 4 ft.	
	14.9	106.4		R		SILT, clayey with sand, tan, stiff, moist	
					10		
					15		
					20		
					25		
					30		
					35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 12/17/96
EQUIPMENT USED: Backhoe
GROUNDWATER LEVEL: Not encountered

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SOILS AND GEOTECHNICAL CONSULTANTS

LOG OF TEST EXPLORATION #5

PROJECT | DATE

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
15.2	109.0		R	0	FILL SOILS SAND, clayey and base material, brown, very hard, most	
				5	NATIVE SOILS CLAY, silty, sandy, dark brown, stiff, moist	
14.7	107.2		R		SILT, clayey with some sand, tan, stiff, moist	
				10		
				15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 12/17/96
EQUIPMENT USED: Backhoe
GROUNDWATER LEVEL: Not encountered

NorCal Engineering
SOILS AND GEOTECHNICAL CONSULTANTS

LOG OF TEST EXPLORATION #6

PROJECT 6447-96 **DATE**

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
				0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					Base Material - Brown, very dense, damp	
16.8			B		FILL SOILS CLAY, silty with some sand, dark brown, stiff, moist to very moist with concrete pieces	
16.4	109.2		R	5		
16.4	108.7		R		NATIVE SOILS CLAY, silty with sand, dark brown, stiff, very moist, lighter brown color at 4 ft.	
					SILT, clayey with sand, tan, stiff, moist	
15.9	104.1		R	10		
				15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 12/17/96
EQUIPMENT USED: Backhoe
GROUNDWATER LEVEL: Not encountered

NorCal Engineering
SOILS AND GEOTECHNICAL CONSULTANTS

LOG OF TEST EXPLORATION #7

PROJECT 6447-96 **DATE**

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
				0	Base Material, brown, dense, moist	
20.1			B		CLAY, silty with sand, brown, stiff, very moist to wet, lighter brown color at 4 ft.	
17.2			B	5		
15.9			B		SILT, clayey, sandy, tan, stiff, moist	
				10		
				15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 12/17/96
EQUIPMENT USED: Backhoe
GROUNDWATER LEVEL: Not encountered

NorCal Engineering
SOILS AND GEOTECHNICAL CONSULTANTS

LOG OF TEST EXPLORATION #8

PROJECT 6447-96 **DATE**

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
				0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
17.0	107.1		R		Base Material, brown, loose, moist CLAY, silty with sand, dark brown, stiff, moist	
16.8	106.4		R	5	SILT, clayey with sand, tan, stiff, moist	
15.7	105.9		R			
15.5	106.0		R	10		
				15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 12/17/96
EQUIPMENT USED: Backhoe
GROUNDWATER LEVEL: Not encountered

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LOG OF TEST EXPLORATION #9

PROJECT 6447-96 **DATE**

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
				0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					Pea gravel on tar (1/2")	
					FILL SOILS SILT, sandy with clay, tan, medium stiff, dry, root structures noted	
				5	NATIVE SOILS CLAY, silty with sand, brown, very stiff, moist	
				10		
				15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 12/17/96
EQUIPMENT USED: Backhoe
GROUNDWATER LEVEL: Not encountered

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LOG OF TEST EXPLORATION #10

PROJECT 6447-96 **DATE**

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
7.6			B	0	Pea gravel on tar (½") FILL SOILS SILT, clayey with sand, brown, stiff, dry to damp	
16.4	108.2		R			
				5	CLAY, silty with sand, brown, stiff to very stiff, moist	
15.1	105.1		R			
					SILT, clayey, tan, stiff, moist	
				10		
				15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 12/17/96
EQUIPMENT USED: Backhoe
GROUNDWATER LEVEL: Not encountered

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LOG OF TEST EXPLORATION #11

PROJECT 6447-96 | **DATE**

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
				0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					Pea gravel on tar (½")	
					NATIVE SOILS CLAY, silty with sand, dark brown, stiff, moist	
				5		
					SILT, clayey with some sand, tan, stiff, moist	
				10		
				15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 12/17/96
EQUIPMENT USED: Backhoe
GROUNDWATER LEVEL: Not encountered

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LOG OF TEST EXPLORATION #12

PROJECT 6447-96 **DATE**

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
				0	Pea gravel on tar (½")	
16.0	106.0		R		FILL SOILS CLAY, sandy, silty with minor organic debris, brown, medium stiff, moist	
				5	NATIVE SOILS CLAY, silty with sand, dark brown, stiff, moist, lighter brown color at 4 ft.	
					SILT, clayey, brown, stiff, moist	
				10		
				15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 12/17/96
EQUIPMENT USED: Backhoe
GROUNDWATER LEVEL: Not encountered

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LOG OF TEST EXPLORATION #13

PROJECT 6447-96 **DATE**

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
				0	3" Asphaltic Concrete over 2" Base Material	
18.8	110.8		R		FILL SOILS CLAY, sandy, silty, dark brown to brown, moist, very stiff	
17.7			B			
15.3	106.1		R	5	NATIVE SOILS CLAY, silty, sandy, dark brown, moist, very stiff	
16.1	105.9		R		CLAY, sandy, brown, damp, very stiff	
14.3	107.2		R	10	SILT and SAND, clayey, light brown, moist, stiff, slight decrease in clay with depth	
12.9	110.1		R	15	SAND, fine grained, silty, tan, dense, moist	
12.8	112.0		R	20		
				25		
				30		
				35		

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 1/2/97
EQUIPMENT USED: Hollow Stem Auger
GROUNDWATER LEVEL: Not encountered

NorCal Engineering
SOILS AND GEOTECHNICAL CONSULTANTS

LOG OF TEST EXPLORATION #14

PROJECT 6447-96 **DATE**

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
				0	3" Asphaltic Concrete over 2" Base Material	
					FILL SOILS Silty CLAY, sandy, brown, moist, stiff	
12.2	105.9		R	5	NATIVE SOILS CLAY, silty, sandy, dark brown, moist, stiff	
					CLAY, sandy, brown, moist, very stiff	
12.9	107.1		R		SILT and SAND, clayey, light brown, damp, stiff, decrease in clay with depth	
				10	SAND, fine grained, silty, light brown, damp, very dense	
				15		
				20		
				25		
				30		
				35		

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 1/2/97
EQUIPMENT USED: Hollow Stem Auger
GROUNDWATER LEVEL: Not encountered

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LOG OF TEST EXPLORATION #15

PROJECT 6447-96 | **DATE**

January 14, 1997

Project Number 6447-96

APPENDIX B

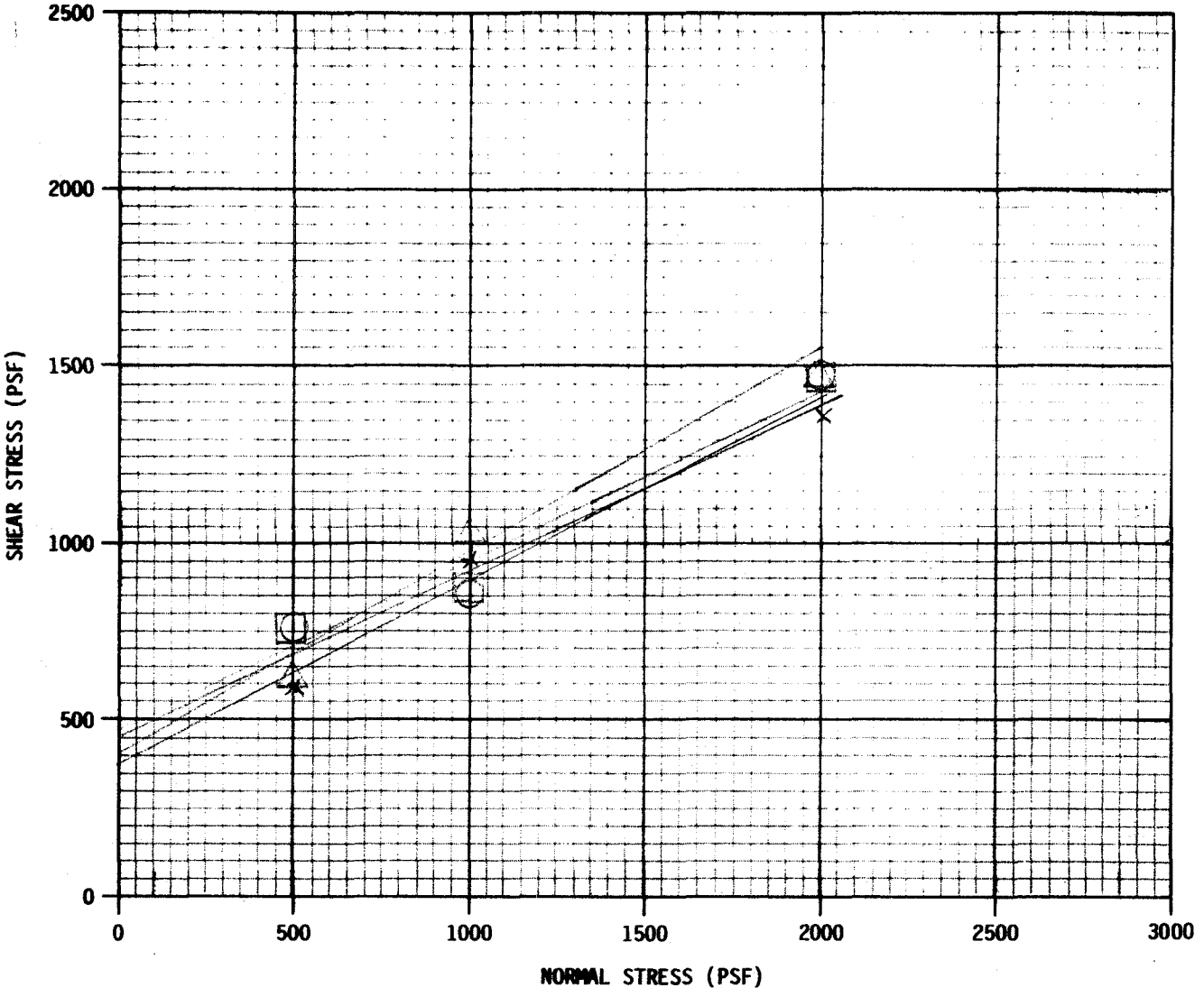
NorCal Engineering

TABLE I
MAXIMUM DENSITY TESTS
(ASTM: D-1557-78)

Sample	Classification	Optimum Moisture	Maximum Dry Density (lbs./cu.ft.)
1 @ 0-2'	CLAY, silty, sandy	13.5	118.0
14 @ 1-3'	CLAY, silty, sandy	14.5	119.0

TABLE II
EXPANSION INDEX TESTS
(U.B.C. STD. 29-2)

Sample	Classification	Expansion Index
1 @ 0-2'	CLAY, silty, sandy	70
14 @ 1-3'	CLAY, silty, sandy	62



SYMBOL	BORING NUMBER	DEPTH (FEET)	ø (DEGREES)	C (PSF)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)
X	4	2.0	27	375	107.7	16.8
O	6	3.0	24	450	109.0	15.2
△	11	3.5	29	400	108.2	16.4
□	14	2.5	26	450	110.8	18.8

NOTE: TESTS PERFORMED ON SATURATED SAMPLES UNLESS SHOWN BELOW.
(FM) FIELD MOISTURE
TESTS PERFORMED ON UNDISTURBED SAMPLES UNLESS SHOWN BELOW.
(R) SAMPLES REMOLDED AT 90% OF MAXIMUM DRY DENSITY

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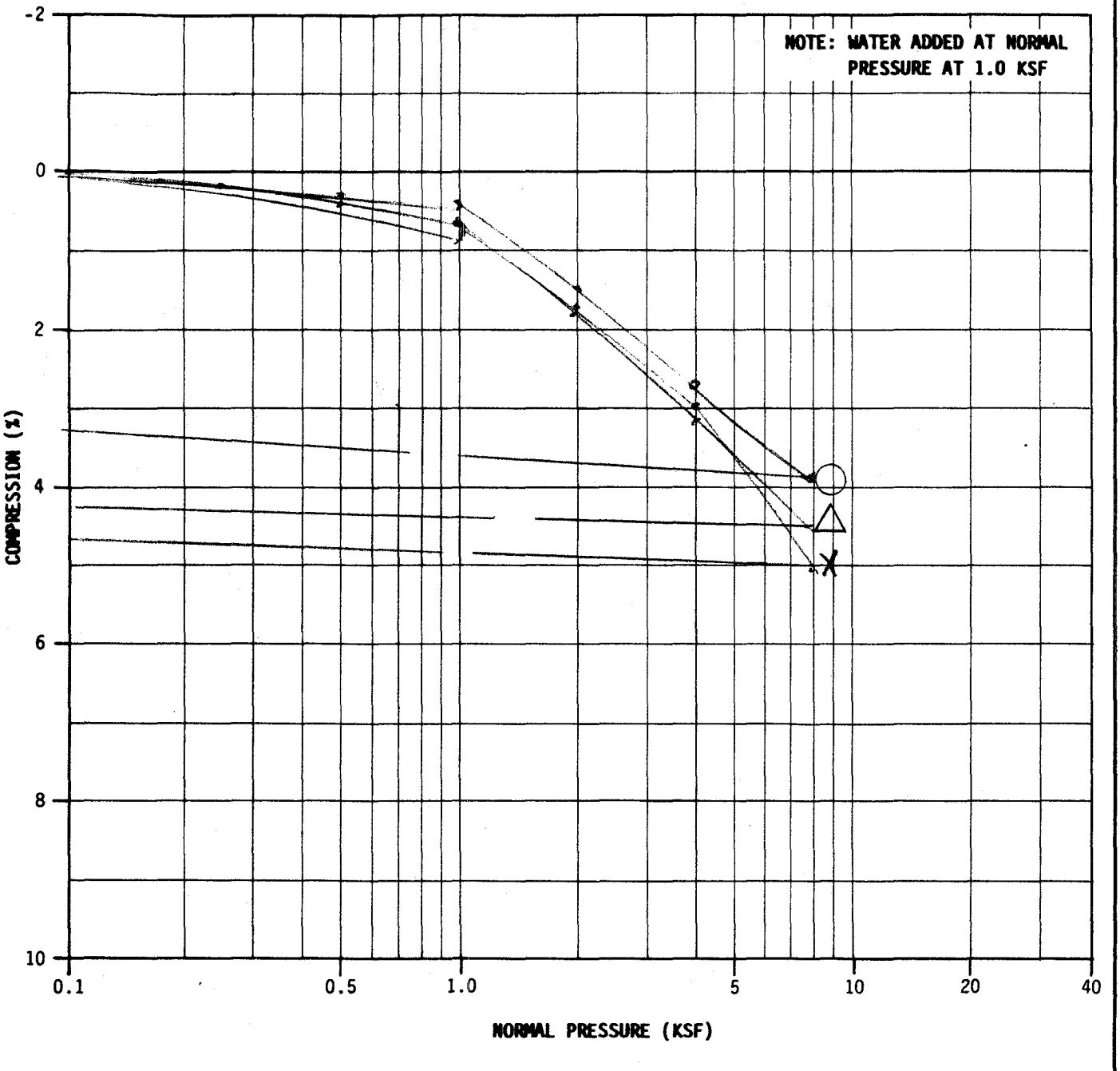
DIRECT SHEAR TEST RESULTS
Plate A



SYMBOL	BORING NUMBER	DEPTH (FEET)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)
X	4	7.5	104.5	20.2		
O	7	5.0	109.2	16.4		
△	9	10.0	106.0	15.0		
□						

——— COMPRESSION (FM) FIELD MOISTURE - NO WATER ADDED

– – – REBOUND (R) SAMPLE REMOLDED AT 90% OF MAXIMUM DRY DENSITY

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CONSOLIDATION TEST RESULTS

Plate B